

**Recovery and Monitoring Plan for *Boltonia decurrens*, FAP 999
(New Mississippi River Crossing, Relocated I-70 and I-64
Connector) and FAP 14 (IL Route 3 Relocation), Madison and
St. Clair Counties, Illinois**

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Introduction

The proposed New Mississippi River Crossing and Illinois Route 3 Realignment projects will result in the incidental taking of plants of *Boltonia decurrens*, the decurrent false aster. *Boltonia decurrens* is currently listed as federally threatened, threatened within the state of Illinois, and endangered in Missouri (U. S. Fish and Wildlife Service, 1990). Twenty-two colonies of decurrent false aster are known to occur in the vicinity of the project area. The New Mississippi River Bridge Crossing will affect an estimated total of 1,600 to 2,200 plants in six different locations. The Route 3 Realignment will impact approximately 140 to 215 plants in five colonies. Approximately 55-60 percent of the populations identified within 0.5 km (0.31 mi) of the project area will be impacted (Illinois Department of Transportation and Missouri Department of Transportation, 2001).

A Biological Assessment describing the impacts of the project was prepared as part of consultation with the U. S. Fish and Wildlife Service. On 7 September 2000 the U. S. Fish and Wildlife Service issued its Biological Opinion regarding the projects and concluded that the proposed work was not likely to jeopardize the continued existence of the species (Collins, 2000). However, the U. S. Fish and Wildlife Service made the following conservation recommendations:

1. Establish populations of *Boltonia decurrens* on all suitable wetland mitigation sites that may be located within the project vicinity.
2. As part of the mitigation plan for *Boltonia decurrens*, implement a monitoring plan for a minimum of five years to determine if the newly established populations are stable or expanding.
3. Implement a monitoring program for the colonies of *Boltonia decurrens* occurring in the project area, but which will not be affected by construction activities to determine if these populations are stable or expanding.
4. Obtain conservation easements on properties containing the largest concentrations of *Boltonia decurrens* to protect these colonies from future developments.

This plan was prepared for the implementation of these conservation recommendations, and is in accordance with the decurrent false aster recovery plan (U. S. Fish and Wildlife Service, 1990). A Preliminary Habitat Enhancement Plan (Illinois Department of Transportation and Missouri Department of Transportation, 2001) was also formulated that proposes the purchase and use of three sites for *Boltonia decurrens* habitat enhancement. Only two of these sites,

however, will be used in implementation of our plan. One of the sites initially chosen for habitat enhancement (the Stallings Site) is, in our opinion, unsuitable for *Boltonia decurrens*.

Biology of Decurrent False Aster

Boltonia decurrens (Torr. & Gray) Wood is a narrow endemic of the Illinois River floodplain and a short section of the Mississippi River, immediately downstream from their confluence. A species of open wetlands, lake shores and banks of streams, *B. decurrens* is declining throughout its range. The decline is presumably due to loss of habitat because of extensive row crop agriculture, excessive siltation in formerly suitable habitats, and loss of dispersal avenues because of levee construction in the floodplain (Schwegman and Nyboer, 1985; Smith and Keevin, 1998).

Boltonia decurrens is well adapted to sites receiving long term flooding. Flooded plants increase aerenchyma and thereby enhance oxygen diffusion to roots under conditions of soil anaerobiosis, enabling them to withstand extended periods of soil saturation (Stoecker, Smith and Melton, 1995).

B. decurrens reproduces vegetatively, by basal sprouts, and sexually (Schwegman and Nyboer, 1985). In natural populations several years old, two distinctive size groups of individuals occur: large flowering plants produced from vegetative rosettes, and smaller individuals produced from spring-germinated seedlings (Smith and Keevin, 1998). In nature, basal rosettes produced in the winter or spring can bolt and set seed in the fall, or overwinter and bolt the following fall. Leafy shoots are produced around the base of the dead stem that flowered the previous season. The ramets are crowded together and compete with each other, resulting in high mortality of the young plants (Smith, Wu and Green, 1993). Achenes germinating in summer or autumn develop into rosettes that live over winter and bolt and flower the following summer. Although seed can germinate in late fall and early winter, mortality of these seedlings is probably very high (Smith and Keevin, 1998). Rhizomes are not produced (Schwegman and Nyboer, 1985). Populations less than a year old will be composed only of smaller plants developed from spring-germinated seedlings.

Abundant seed is produced by each plant under good growing conditions. Approximately 50,000 achenes are produced per individual, and an average plant is capable of producing approximately 40,000 seedlings under optimal conditions for germination (Smith and Keevin, 1998). However, mortality of seedlings is high, and most do not survive to maturity. Larger plants produce more achenes, and larger achenes are more likely to be viable than smaller ones. The floating achenes are dispersed by water, and seeds germinate on moist soil or while still afloat. *Boltonia decurrens* may persist in soil seed banks (U. S. Fish and Wildlife Service, 1990), and achenes probably have the capacity for long-term viability when buried in soil and subjected to natural seasonal temperature changes (Baskin and Baskin, 2002). Soil disturbance, presumably through erosion by intense flooding, is necessary to activate the seed bank since germination will not occur in darkness (U. S. Fish and Wildlife Service, 1990; Smith and Keevin, 1998; Baskin and Baskin, 2002). Seeds of *Boltonia decurrens* are conditionally dormant at maturity (Baskin and Baskin, 1988; 2002), requiring high temperatures for germination. However, fresh seed will germinate if the temperature is high enough, and some fall germination does occur before stratification (Smith and Keevin, 1998). Baskin and Baskin (2002) claim seeds can germinate throughout the growing season (late March to late October) if light and soil moisture conditions become nonlimiting. In a greenhouse study, they found that seeds treated to cold stratification germinated at rates of 95-100%.

In the absence of flooding, *B. decurrens* is a poor competitor with other early successional plants, and areas where the species is abundant are often low in species richness. Populations are known to fluctuate greatly, and may completely disappear and reappear on a cycle related to flood and drought. Greenhouse experiments indicate that *Boltonia decurrens* requires high levels of light for optimal photosynthesis and growth (Smith, Wu and Green, 1993). This sensitivity to light might help explain the disappearance of populations from disturbed areas after several years of natural succession. Field investigations have shown that the species lacks sexual reproduction in dense, weedy habitats and vegetative regeneration also ceases after four or five years. Studies have demonstrated that, for proliferation, *Boltonia* requires regular disturbance (which provides high light), moist soil, and elimination of competitors (Smith et al. 1998; U. S. Fish and Wildlife Service, 1990). *B. decurrens* appears to increase under two scenarios: 1) after severe flooding kills competing vegetation, and 2) after drought conditions expose bare mudflats along lakeshores. Smith et al. (1998) and others found that sites experiencing severe flooding had much greater increases in *Boltonia* than sites with minor flooding. In addition to natural habitats, a major habitat type for *B. decurrens* in recent times is lowland area disturbed by human activity such as cropping or ditching. Presumably, these activities provide bare, moist soil favorable for germination of seed floated in by floodwaters and may expose the seed bank to necessary light levels (U. S. Fish and Wildlife Service, 1990).

Although in one study (Smith, 1990), a planting of 2500 *B. decurrens* seeds on a site on the Mississippi River floodplain failed, the species is generally found to be easily propagated by seed, cuttings, or transplanting. Seed may be cold stratified for 6 to 10 weeks and sown in the spring, by scattering on soil surface. Germination will not occur in darkness. Suitable sites are those where regular flooding creates an open, moist habitat. Disking, mowing or prescribed burning may increase population size (Smith et al. 1998; U. S. Fish and Wildlife Service, 1990).

Because *B. decurrens* is adapted to a dynamic floodplain system, protection of specific populations from disturbances is not sufficient to ensure survival (Smith et al. 1998). We suggest a landscape level approach where numerous suitable low lying, unveeved sites are secured throughout the species' range. We propose that for this project, restoration of *Boltonia decurrens* to compensate for impacts to the species by Illinois Department of Transportation (IDOT) projects in the American Bottoms, a minimum of three low lying, flood susceptible sites be secured. The sites should be a minimum of 1.6 ha. (4 acres) in size. Seed should be collected from a minimum of two existing *B. decurrens* populations. At each site, a comparison of three methods of *Boltonia decurrens* establishment will be conducted over a period of seven years. After initial disking of study plots, the three treatments will be 1) sowing seed and mowing every two years, 2) sowing seed and disking every two years, and 3) sowing seed and allowing natural revegetation.

Methods

At present, only one of the study sites is known (the Cahokia Site), and only one source for seed collection (Fairmont Golf Course Site) has been identified. The Preliminary Habitat Enhancement Plan (Illinois Department of Transportation and Missouri Department of Transportation, 2001) identified three sites for possible *Boltonia* habitat enhancement; the Fairmont Golf Course Site, the Stallings Site, and the Cahokia Site. A survey of the Fairmont Golf Course Site in 2001 revealed an already thriving population of *Boltonia decurrens* within the suitable habitat present. For this reason, the Fairmont Golf Course Site is unsuitable for a study of this sort, and planting of additional plants there would not be worthwhile. An estimated 600-1000 plants are already present. However, this site is ideal as a seed source. As mentioned previously, in our opinion, the Stallings Site is

unsuitable for *Boltonia decurrens*. This site does not have a source for over-bank flooding, and probably does not have the hydrologic conditions necessary for a plant that relies on disturbance caused by frequent and severe flooding. The Cahokia Site, however, appears to be suitable for establishment of *Boltonia decurrens*. Two additional sites will be required for establishment of *Boltonia decurrens*. Additional sources of seed, on property secured by the IDOT, are also required. A site in Centreville, currently being investigated as a wetland mitigation site, will also be used for establishment of *Boltonia decurrens* if acquired by IDOT.

At each study site, five plots for each of the three treatments (15 plots total) will be established in three parallel rows 30 m apart located within strips 75 ft by 540 ft (0.93 acre or 0.38 ha). The plots are 500 m² (20 m x 25 m) at 30 m intervals along transects. After disking, the strips will receive equal quantities of seed (0.7 liter) collected from the Fairmont Golf Course Site and a yet to be determined population. Each plot corner (offset 3 m) will be permanently marked with a 1.5 m high steel post. In the spring (May) of years 2, 4 and 6, strips containing plots will be mowed or disked by IDOT or contract personnel. Soils for each plot will be described by INHS soil scientists and hydrology of each site will be monitored monthly by ISGS scientists. In each plot, each fall, INHS scientists will quantitatively sample vegetation, using transects and 1 m² quadrats. *Boltonia decurrens* density, vegetation height, density and species composition, soil texture and degree of inundation will be compared between treatments and between sites. It is essential that tree planting and natural tree regeneration be excluded from a zone bordering the *Boltonia decurrens* plantings. Therefore, each 0.93 acre (0.38 ha) mowed or disked strip will be located in a 4.0 acre (1.6 ha) area kept clear of woody vegetation. Following the seven-year study, these areas should continue to be mowed at least every three or four years to maintain conditions suitable for *Boltonia* colonization. Work will begin at the Cahokia Site in the spring of 2002. Plots will be established on the northwest part of the site (Figure 1). The project will be deemed successful if, over the course of five years, a total of at least 2000 plants is maintained over the three study sites (mean density, 360/acre over 5.6 acres). Although monitoring, mowing and disking of the *Boltonia* treatment plots will be carried out for a period of seven years, regulatory requirements dictate that results be submitted after five years for determination of the success or failure of the above performance criterion.

Because *Boltonia decurrens* is a poor competitor in the absence of flooding, care should be taken when choosing other species to plant in the vicinity of decurrent false aster. As previously mentioned, woody species should not be planted close to the *Boltonia* plots. Herbaceous plants should be low-growing and non-aggressive species that do not form colonies that exclude other vegetation. A list of recommended herbaceous species can be found in Table 1.

In addition, we propose that the Fairmont Golf Course Site be mowed every three or four years to maintain conditions favorable for the current healthy *Boltonia* population. Mowing will reduce competition and increase available light for *Boltonia decurrens* and should take place after the plants have set seed in the fall (November) and before they bolt in the early summer (June). We recommend from February to mid May. This time frame would allow enough time for seed dispersal over the early winter, and would be well before bolting in early summer. Although mowing at this time is unlikely to reduce competition from herbaceous plants, it will eliminate competition from trees and shrubs.

Illinois Natural History Survey staff will monitor additional *Boltonia* sites within the designated project area (Figure 2), make management recommendations, and keep the IDOT informed of activities and developments. All 22 populations within the project area, plus any additional populations yet to be found, will be monitored yearly, as recommended

by the Fish and Wildlife Service (Collins, 2000). Included within these populations are two colonies (20 & 21) at the Fairmont Golf Course Site, owned by the Department of Transportation. These populations are not shown on Figure 2. In addition to these 22 populations, the Fairmont City Site and the Eckmann-Bischoff Property colonies will be monitored. The Fairmont City Site is recognized as a natural area by the Illinois Natural Areas Inventory, primarily because of a large population of *Boltonia decurrens*. This site is just west of the Fairmont Golf Course Site. In 2000, two plants of *Boltonia decurrens* were found at the Eckmann-Bischoff Property (Ketzner et al., 2001). This site is owned by the Illinois Department of Transportation. Populations will be monitored in August, September and October, beginning in 2002, to determine if they are stable or expanding. If after five years the population is found stable or expanding, that population will be considered to be recovered (U. S. Fish and Wildlife Service, 1990). Flowering stems will be counted or sampled and used as an indicator of the health of each population.

Site specific management recommendations will be made for each population in the vicinity of the project area, whether in public ownership or not. Management recommendations may include mowing, burning, tree removal or other, depending on the characteristics of the population and the site.

Yearly reports will be submitted to the IDOT regarding the progress of the *Boltonia* establishment at the mitigation sites, the results of monitoring of the 22 populations within the project area, and site specific management recommendations. The IDOT will notify the U. S. Fish and Wildlife Service about the implementation of any conservation recommendations and the progress of the recovery efforts.

As pointed out by Smith and Keevin (1998), the feasibility of substituting alternative site disturbance such as disking, mowing, burning, or controlled flooding for maintenance of *Boltonia decurrens* is unknown. This plan calls for the investigation of the effects of the alternative site disturbances of disking and mowing. Results should provide useful information required for better management and long term survival of the species.

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Table 1. Recommended species for planting at the Cahokia Site.

Species	Common Name	Growth Form
<i>Alisma plantago-aquatica</i>	water-plantain	perennial herb
<i>Ammannia coccinea</i>	long-leaved ammannia	annual herb
<i>Asclepias incarnata</i>	swamp milkweed	perennial herb
<i>Bidens aristosa</i>	swamp marigold	annual herb
<i>Boehmeria cylindrica</i>	false nettle	perennial herb
<i>Carex frankii</i>	sedge	perennial herb
<i>Carex tribuloides</i>	sedge	perennial herb
<i>Carex vulpinoidea</i>	fox sedge	perennial herb
<i>Cicuta maculata</i>	water hemlock	biennial herb
<i>Cyperus acuminatus</i>	flat sedge	annual herb
<i>Cyperus strigosus</i>	straw-colored flatsedge	perennial herb
<i>Desmanthus illinoensis</i>	Illinois mimosa	annual herb
<i>Eleocharis acicularis</i>	needle spike rush	perennial herb
<i>Eleocharis obtusa</i>	spike rush	annual herb
<i>Eleocharis smallii</i>	spike rush	perennial herb
<i>Elymus virginicus</i>	Virginia wild rye	perennial herb
<i>Euthamia graminifolia</i>	grassleaf goldenrod	perennial herb
<i>Galium obtusum</i>	wild madder	perennial herb
<i>Helenium autumnale</i>	autumn sneezeweed	perennial herb
<i>Juncus acuminatus</i>	rush	perennial herb
<i>Juncus nodatus</i>	stout rush	perennial herb
<i>Juncus torreyi</i>	Torrey's rush	perennial herb
<i>Lobelia siphilitica</i>	blue cardinal-flower	perennial herb
<i>Ludwigia alternifolia</i>	seedbox	perennial herb
<i>Ludwigia polycarpa</i>	false loosestrife	perennial herb
<i>Lycopus americanus</i>	water horehound	perennial herb
<i>Lysimachia ciliata</i>	fringed loosestrife	perennial herb
<i>Lysimachia lanceolata</i>	lance-leaved loosestrife	perennial herb
<i>Lythrum alatum</i>	winged loosestrife	perennial herb
<i>Mimulus alatus</i>	winged monkey-flower	perennial herb
<i>Panicum rigidulum</i>	munro grass	perennial herb
<i>Penthorum sedoides</i>	ditch stonecrop	perennial herb
<i>Phyla lanceolata</i>	fog-fruit	perennial herb
<i>Physostegia virginiana</i>	false dragonhead	perennial herb
<i>Sagittaria latifolia</i>	arrowhead	perennial herb
<i>Stachys palustris</i>	woundwort	perennial herb
<i>Vernonia fasciculata</i>	common ironweed	perennial herb

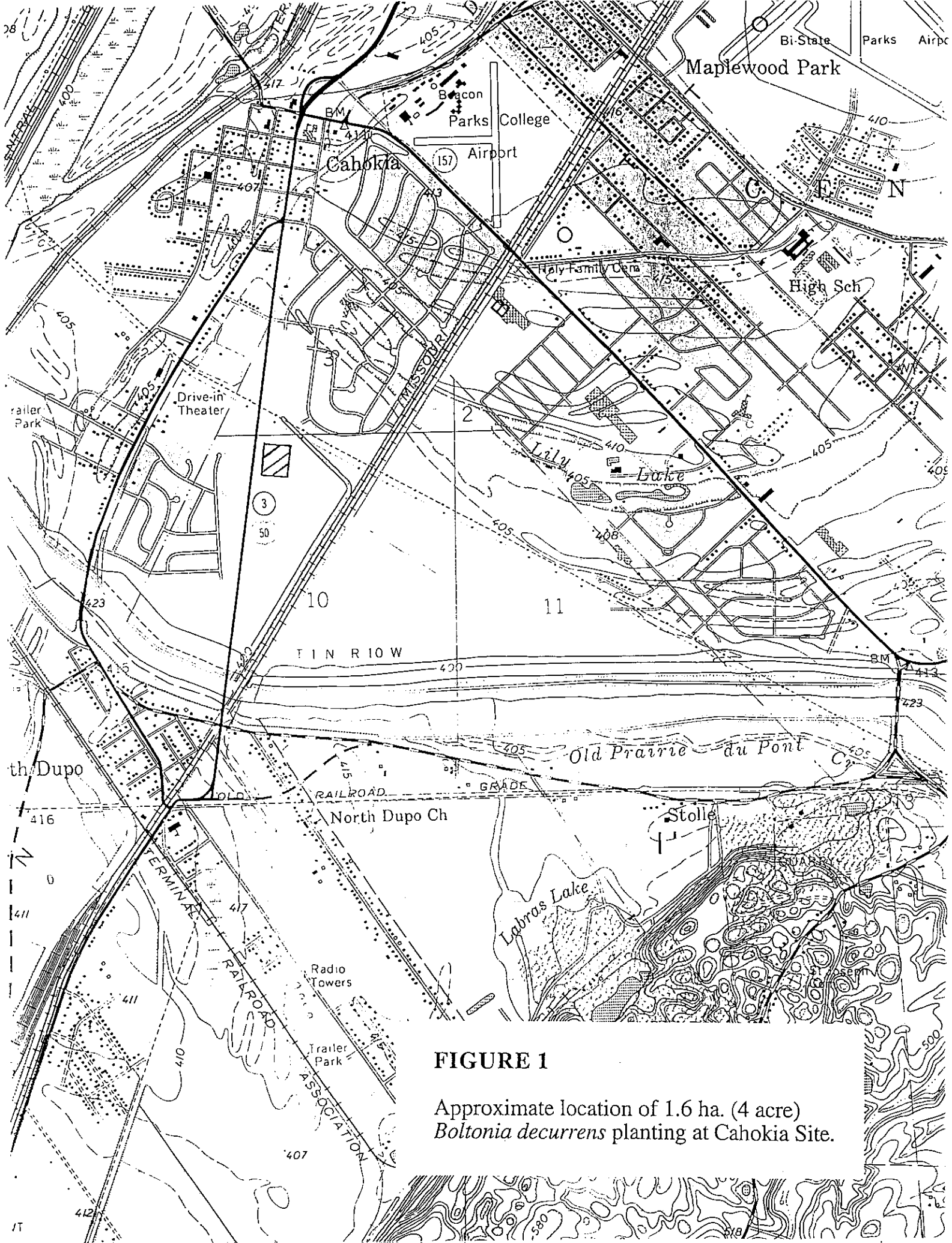


FIGURE 1

Approximate location of 1.6 ha. (4 acre)
Boltonia decurrens planting at Cahokia Site.